

$$\Sigma(2030) 7/2^+$$

$$I(J^P) = 1(7/2^+) \text{ Status: } ****$$

Discovered by COOL 66 and by WOHL 66. For most results published before 1974 (they are now obsolete), see our 1982 edition Physics Letters **111B** 1 (1982).

This entry only includes results from partial-wave analyses. Parameters of peaks seen in cross sections and invariant-mass distributions around 2030 MeV may be found in our 1984 edition, Reviews of Modern Physics **56** S1 (1984).

NODE=B047

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$\Sigma(2030)$ MASS

NODE=B047M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2025 to 2040 (\approx 2030) OUR ESTIMATE			
2036 \pm 5	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
2038 \pm 10	CORDEN	77B	$K^-N \rightarrow N\bar{K}^*$
2040 \pm 5	GOPAL	77	DPWA $\bar{K}N$ multichannel
2030 \pm 3	¹ CORDEN	76	DPWA $K^-n \rightarrow \Lambda\pi^-$
2035 \pm 15	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$
2038 \pm 10	HEMINGWAY	75	DPWA $K^-p \rightarrow \bar{K}N$
2042 \pm 11	VANHORN	75	DPWA $K^-p \rightarrow \Lambda\pi^0$
2020 \pm 6	KANE	74	DPWA $K^-p \rightarrow \Sigma\pi$
2035 \pm 10	LITCHFIELD	74B	DPWA $K^-p \rightarrow \Lambda(1520)\pi^0$
2020 \pm 30	LITCHFIELD	74C	DPWA $K^-p \rightarrow \Delta(1232)\bar{K}$
2025 \pm 10	LITCHFIELD	74D	DPWA $K^-p \rightarrow \Lambda(1820)\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2027 to 2057	GOYAL	77	DPWA $K^-N \rightarrow \Sigma\pi$
2030	DEBELLEFON	76	IPWA $K^-p \rightarrow \Lambda\pi^0$

NODE=B047M

→ UNCHECKED ←

$\Sigma(2030)$ WIDTH

NODE=B047W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
150 to 200 (\approx 180) OUR ESTIMATE			
172 \pm 10	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
137 \pm 40	CORDEN	77B	$K^-N \rightarrow N\bar{K}^*$
190 \pm 10	GOPAL	77	DPWA $\bar{K}N$ multichannel
201 \pm 9	¹ CORDEN	76	DPWA $K^-n \rightarrow \Lambda\pi^-$
180 \pm 20	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$
172 \pm 15	HEMINGWAY	75	DPWA $K^-p \rightarrow \bar{K}N$
178 \pm 13	VANHORN	75	DPWA $K^-p \rightarrow \Lambda\pi^0$
111 \pm 5	KANE	74	DPWA $K^-p \rightarrow \Sigma\pi$
160 \pm 20	LITCHFIELD	74B	DPWA $K^-p \rightarrow \Lambda(1520)\pi^0$
200 \pm 30	LITCHFIELD	74C	DPWA $K^-p \rightarrow \Delta(1232)\bar{K}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
260	DECLAIS	77	DPWA $\bar{K}N \rightarrow \bar{K}N$
126 to 195	GOYAL	77	DPWA $K^-N \rightarrow \Sigma\pi$
160	DEBELLEFON	76	IPWA $K^-p \rightarrow \Lambda\pi^0$
70 to 125	LITCHFIELD	74D	DPWA $K^-p \rightarrow \Lambda(1820)\pi^0$

NODE=B047W

→ UNCHECKED ←

$\Sigma(2030)$ DECAY MODES

NODE=B047215;NODE=B047

Mode	Fraction (Γ_i/Γ)
Γ_1 $N\bar{K}$	17–23 %
Γ_2 $\Lambda\pi$	17–23 %
Γ_3 $\Sigma\pi$	5–10 %
Γ_4 ΞK	<2 %
Γ_5 $\Sigma(1385)\pi$	5–15 %
Γ_6 $\Sigma(1385)\pi, F\text{-wave}$	
Γ_7 $\Lambda(1520)\pi$	10–20 %
Γ_8 $\Lambda(1520)\pi, D\text{-wave}$	

DESIG=1;OUR EST

DESIG=2;OUR EST

DESIG=3;OUR EST

DESIG=4;OUR EST

DESIG=10;OUR EST

DESIG=21

DESIG=181;OUR EST

DESIG=6

Γ_9	$\Lambda(1520)\pi$, G-wave		DESIG=7
Γ_{10}	$\Delta(1232)\bar{K}$	10–20 %	DESIG=182;OUR EST
Γ_{11}	$\Delta(1232)\bar{K}$, F-wave		DESIG=8
Γ_{12}	$\Delta(1232)\bar{K}$, H-wave		DESIG=9
Γ_{13}	$N\bar{K}^*(892)$	<5 %	DESIG=183;OUR EST
Γ_{14}	$N\bar{K}^*(892)$, S=1/2, F-wave		DESIG=11
Γ_{15}	$N\bar{K}^*(892)$, S=3/2, F-wave		DESIG=12
Γ_{16}	$\Lambda(1820)\pi$, P-wave		DESIG=5

The above branching fractions are our estimates, not fits or averages.

$\Sigma(2030)$ BRANCHING RATIOS

NODE=B047220

See "Sign conventions for resonance couplings" in the Note on Λ and Σ Resonances.

NODE=B047220

$\Gamma(N\bar{K})/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
0.17 to 0.23 OUR ESTIMATE				
0.19±0.03	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$	
0.18±0.03	HEMINGWAY	75	DPWA $K^-p \rightarrow \bar{K}N$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.15	DECLAIS	77	DPWA $\bar{K}N \rightarrow \bar{K}N$	
0.24±0.02	GOPAL	77	DPWA See GOPAL 80	

NODE=B047R1
 NODE=B047R1
 → UNCHECKED ←

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Lambda\pi$				$(\Gamma_1\Gamma_2)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
+0.18 ±0.02	GOPAL	77	DPWA $\bar{K}N$ multichannel	
+0.20 ±0.01	¹ CORDEN	76	DPWA $K^-n \rightarrow \Lambda\pi^-$	
+0.18 ±0.02	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$	
+0.20 ±0.01	VANHORN	75	DPWA $K^-p \rightarrow \Lambda\pi^0$	
+0.195±0.053	DEVENISH	74B	Fixed-t dispersion rel.	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.20	DEBELLEFON	76	IPWA $K^-p \rightarrow \Lambda\pi^0$	

NODE=B047R2
 NODE=B047R2

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Sigma\pi$				$(\Gamma_1\Gamma_3)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
-0.09 ±0.01	² CORDEN	77C	$K^-n \rightarrow \Sigma\pi$	
-0.06 ±0.01	² CORDEN	77C	$K^-n \rightarrow \Sigma\pi$	
-0.15 ±0.03	GOPAL	77	DPWA $\bar{K}N$ multichannel	
-0.10 ±0.01	KANE	74	DPWA $K^-p \rightarrow \Sigma\pi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.085±0.02	³ GOYAL	77	DPWA $K^-N \rightarrow \Sigma\pi$	

NODE=B047R3
 NODE=B047R3

OCCUR=2

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Xi K$				$(\Gamma_1\Gamma_4)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
0.023	MULLER	69B	DPWA $K^-p \rightarrow \Xi K$	
<0.05	BURGUN	68	DPWA $K^-p \rightarrow \Xi K$	
<0.05	TRIPP	67	RVUE $K^-p \rightarrow \Xi K$	

NODE=B047R4
 NODE=B047R4

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Lambda(1820)\pi$, P-wave				$(\Gamma_1\Gamma_{16})^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
0.14±0.02	CORDEN	75B	DBC $K^-n \rightarrow N\bar{K}\pi^-$	
0.18±0.04	LITCHFIELD	74D	DPWA $K^-p \rightarrow \Lambda(1820)\pi^0$	

NODE=B047R5
 NODE=B047R5

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Lambda(1520)\pi$, D-wave				$(\Gamma_1\Gamma_8)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
+0.114±0.010	⁴ CAMERON	77	DPWA $K^-p \rightarrow \Lambda(1520)\pi^0$	
0.14 ±0.03	LITCHFIELD	74B	DPWA $K^-p \rightarrow \Lambda(1520)\pi^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.10 ±0.03	⁵ CORDEN	75B	DBC $K^-n \rightarrow N\bar{K}\pi^-$	

NODE=B047R6
 NODE=B047R6

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Lambda(1520)\pi$, G-wave	$(\Gamma_1 \Gamma_9)^{1/2} / \Gamma$		
VALUE	DOCUMENT ID	TECN	COMMENT
$+0.146 \pm 0.010$	⁴ CAMERON 77	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$
0.02 ± 0.02	LITCHFIELD 74B	DPWA	$K^- p \rightarrow \Lambda(1520)\pi^0$

NODE=B047R7
NODE=B047R7

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Delta(1232)\bar{K}$, F-wave	$(\Gamma_1 \Gamma_{11})^{1/2} / \Gamma$		
VALUE	DOCUMENT ID	TECN	COMMENT
0.16 ± 0.03	LITCHFIELD 74C	DPWA	$K^- p \rightarrow \Delta(1232)\bar{K}$
0.17 ± 0.03	⁵ CORDEN 75B	DBC	$K^- n \rightarrow N\bar{K}\pi^-$

NODE=B047R8
NODE=B047R8

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Delta(1232)\bar{K}$, H-wave	$(\Gamma_1 \Gamma_{12})^{1/2} / \Gamma$		
VALUE	DOCUMENT ID	TECN	COMMENT
0.00 ± 0.02	LITCHFIELD 74C	DPWA	$K^- p \rightarrow \Delta(1232)\bar{K}$

NODE=B047R9
NODE=B047R9

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow \Sigma(1385)\pi$	$(\Gamma_1 \Gamma_5)^{1/2} / \Gamma$		
VALUE	DOCUMENT ID	TECN	COMMENT
$+0.153 \pm 0.026$	⁴ CAMERON 78	DPWA	$K^- p \rightarrow \Sigma(1385)\pi$

NODE=B047R10
NODE=B047R10

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow N\bar{K}^*(892)$, S=1/2, F-wave	$(\Gamma_1 \Gamma_{14})^{1/2} / \Gamma$		
VALUE	DOCUMENT ID	TECN	COMMENT
$+0.06 \pm 0.03$	⁴ CAMERON 78B	DPWA	$K^- p \rightarrow N\bar{K}^*$
-0.02 ± 0.01	CORDEN 77B		$K^- d \rightarrow NN\bar{K}^*$

NODE=B047R11
NODE=B047R11

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(2030) \rightarrow N\bar{K}^*(892)$, S=3/2, F-wave	$(\Gamma_1 \Gamma_{15})^{1/2} / \Gamma$		
VALUE	DOCUMENT ID	TECN	COMMENT
$+0.04 \pm 0.03$	⁶ CAMERON 78B	DPWA	$K^- p \rightarrow N\bar{K}^*$
-0.12 ± 0.02	CORDEN 77B		$K^- d \rightarrow NN\bar{K}^*$

NODE=B047R12
NODE=B047R12

$\Sigma(2030)$ FOOTNOTES

- Preferred solution 3; see CORDEN 76 for other possibilities.
- The two entries for CORDEN 77C are from two different acceptable solutions.
- This coupling is extracted from unnormalized data.
- The published sign has been changed to be in accord with the baryon-first convention.
- An upper limit.
- The upper limit on the G_3 wave is 0.03.

NODE=B047

NODE=B047;LINKAGE=A
NODE=B047;LINKAGE=C
NODE=B047;LINKAGE=D
NODE=B047;LINKAGE=H
NODE=B047;LINKAGE=G
NODE=B047;LINKAGE=K

$\Sigma(2030)$ REFERENCES

PDG 84	RMP 56 S1	C.G. Wohl <i>et al.</i>	(LBL, CIT, CERN)
PDG 82	PL 111B 1	M. Roos <i>et al.</i>	(HELS, CIT, CERN)
GOPAL 80	Toronto Conf. 159	G.P. Gopal	(RHEL) IJP
CAMERON 78	NP B143 189	W. Cameron <i>et al.</i>	(RHEL, LOIC) IJP
CAMERON 78B	NP B146 327	W. Cameron <i>et al.</i>	(RHEL, LOIC) IJP
CAMERON 77	NP B131 399	W. Cameron <i>et al.</i>	(RHEL, LOIC) IJP
CORDEN 77B	NP B121 365	M.J. Corden <i>et al.</i>	(BIRM) IJP
CORDEN 77C	NP B125 61	M.J. Corden <i>et al.</i>	(BIRM) IJP
DECLAIS 77	CERN 77-16	Y. Declais <i>et al.</i>	(CAEN, CERN) IJP
GOPAL 77	NP B119 362	G.P. Gopal <i>et al.</i>	(LOIC, RHEL) IJP
GOYAL 77	PR D16 2746	D.P. Goyal, A.V. Sodhi	(DELH) IJP
CORDEN 76	NP B104 382	M.J. Corden <i>et al.</i>	(BIRM) IJP
DEBELLEFON 76	NP B109 129	A. de Bellefon, A. Berthon	(CDEF) IJP
BAILLON 75	NP B94 39	P.H. Baillon, P.J. Litchfield	(CERN, RHEL) IJP
CORDEN 75B	NP B92 365	M.J. Corden <i>et al.</i>	(BIRM) IJP
HEMINGWAY 75	NP B91 12	R.J. Hemingway <i>et al.</i>	(CERN, HEIDH, MPIM) IJP
VANHORN 75	NP B87 145	A.J. van Horn	(LBL) IJP
Also	NP B87 157	A.J. van Horn	(LBL) IJP
DEVENISH 74B	NP B81 330	R.C.E. Devenish, C.D. Froggatt, B.R. Martin	(DESY+) IJP
KANE 74	LBL-2452	D.F. Kane	(LBL) IJP
LITCHFIELD 74B	NP B74 19	P.J. Litchfield <i>et al.</i>	(CERN, HEIDH) IJP
LITCHFIELD 74C	NP B74 39	P.J. Litchfield <i>et al.</i>	(CERN, HEIDH) IJP
LITCHFIELD 74D	NP B74 12	P.J. Litchfield <i>et al.</i>	(CERN, HEIDH) IJP
MULLER 69B	Thesis UCRL 19372	R.A. Muller	(LRL)
BURGUN 68	NP B8 447	G. Burgun <i>et al.</i>	(SACL, CDEF, RHEL)
TRIPP 67	NP B3 10	R.D. Tripp <i>et al.</i>	(LRL, SLAC, CERN+)
COOL 66	PRL 16 1228	R.L. Cool <i>et al.</i>	(BNL)
WOHL 66	PRL 17 107	C.G. Wohl, F.T. Solmitz, M.L. Stevenson	(LRL) IJP

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